Having thus described the invention, what is claimed as new and secured by Letters Patent is:

1. A method of packet grooming and aggregation within an Ethernet over SONET/SDH system (EOS system), said method comprising:

delivering efficient bandwidth per data stream; and

mapping each said data stream directly to a physical transport interface independent of any Layer 2 bridging or Layer 3 routing protocol.

2. The method as claimed in **Claim 1** wherein,

said mapping step is flexible in that service flow is defined independent of any given physical Ethernet port or Sonet/SDH virtual concatenation groups (VCG) so as to allow flexible mapping of said service flow among said physical Ethernet ports and SONET/SDH VCG transport pipes and to guarantee quality of service levels of service flow during said flexible mapping.

3. An Ethernet over SONET/SDH system (EOS system), said EOS system comprising:

an Ethernet MAC subsystem for providing MAC and PHY layer functionality for a plurality of Ethernet ports;

an Aggregation/Grooming Engine (AGE) for providing grooming and aggregation functionality of said EOS system including label lookup, flow buffering, label editing, and flow scheduling;

an Encapsulation Engine for providing adaptation between Ethernet frames and related SONET/SDH byte streams using adaptation protocols;

a SONET/SDH Virtual Concatenation processor for providing byte stream transport pipes of flexible bandwidth via concatenating a number of SONET/SDH time slots; and

a SONET/SDH protocol processor for providing overhead processing;

wherein said AGE maps client flows with quality of service assurance between said plurality of Ethernet ports and corresponding SONET/SDH Virtual Concatenation Groups.

4. An Aggregation/Grooming Engine (AGE) for use within an Ethernet over SONET/SDH system (EOS system), said AGE comprising:

an ingress portion having

an ingress header unit for receiving data from an Ethernet MAC subsystem;

an ingress lookup engine including a corresponding ingress flow database and coupled to said ingress header unit;

an ingress tag editor coupled to said ingress lookup engine; and

an ingress flow FIFO unit coupled to said ingress tag editor and an encapsulation engine; and

an egress portion having

an egress header unit for receiving data from said encapsulation engine;

an egress lookup engine including a corresponding egress flow database and coupled to said egress header unit;

an egress tag editor coupled to said egress lookup engine; and

an egress flow FIFO unit coupled to said egress tag editor and said Ethernet MAC subsystem;

wherein said ingress portion and said egress portion of said AGE provide grooming and aggregation functionality for said EOS system including label lookup, flow buffering, label editing, and flow scheduling.

5. The AGE as claimed in **Claim 4** wherein said ingress flow FIFO unit and said egress flow FIFO unit are multi-channel FIFOs where each buffers respective data flow for one service flow.

6. The AGE as claimed in **Claim 4** wherein said ingress flow FIFO unit and said egress flow FIFO unit each include only a single reader and a single writer.

7. The AGE as claimed in **Claim 4** wherein said ingress portion and said egress portion form symmetric ingress and egress paths.

8. The AGE as claimed in **Claim 4** wherein said ingress lookup engine and said egress lookup engine are integrated into a single bi-directional lookup engine having a corresponding bi-directional flow database that integrates said ingress flow database and said egress flow database.

9. A method of packet grooming and aggregation within an Ethernet over SONET/SDH system (EOS system), said method comprising:

receiving a data packet;

providing an input client frame from said data packet to a header unit;

extracting a search key from said input client frame via said header unit;

correlating said search key via a lookup engine to a match in a flow database to determine flow context;

modifying said input client frame via a tag editor according to said flow context;

buffering said input client frame via a flow FIFO;

applying appropriate discard policies to said flow FIFO; and

scheduling said input client frame via a scheduler of the flow FIFO for transmission into output channels according to output channel status and flow quality of service parameters.

10. The method of packet grooming and aggregation as claimed in **Claim 9** wherein said scheduling step occurs in accordance with an AGE flow database.

11. The method of packet grooming and aggregation as claimed in **Claim 10** further including the steps of:

receiving said search key,

performing a wildcard linear search against predetermined search key fields of said AGE flow database,

fetching flow context from said AGE database, and

outputting flow context.

12. The method of packet grooming and aggregation as claimed in **Claim 9** wherein said correlating step occurs in accordance with a combined ingress table and egress table in a bi-directional lookup manner.

13. The method of packet grooming and aggregation as claimed in **Claim 12** further including the steps of:

receiving said search key,

upon determining an ingress lookup,

performing a first wildcard linear search of said search key against predetermined ingress flow fields of a bi-directional flow database,

fetching flow context from said egress flow fields of said bi-directional flow database,

upon determining an egress lookup,

performing a second wildcard linear search of said search key against predetermined egress flow fields of a bi-directional flow database,

fetching flow context from said egress flow fields of said bi-directional flow database,

modifying a portion of said egress flow fields according to predetermined rules, and

outputting flow context.